Center for Grassland Studies

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Tracking Trout Lilies: Hybridization, Species Boundaries, and Conservation in the Genus *Erythronium*

Kathy Roccaforte, School of Biological Sciences, UNL

Introduction

There are approximately 250,000 extant species of flowering plants on Earth. How did this vast diversity of species form, and how do species remain genetically distinct from one another? These questions have intrigued scientists for decades, and although great progress has been made in the field of speciation research, we still have much to learn about species formation and the maintenance of species boundaries in the face of hybridization and gene flow.[1] Further, human-induced land use changes can alter patterns of hybridization and erode species boundaries by bringing formerly isolated species into closer contact.[2] For the past three years, my M.S. research has focused on investigating the mechanisms that underlie hybridization and species boundaries in midwestern trout lilies (*Erythronium*), as well as examining how land use changes in grasslands may affect these processes.

Figure 1: *Andrena* **sp. (left) foraging for nectar on** *E. mesochoreum* **at Madigan prairie in Saunders Co., NE.** *E. albidum* **(right) and an insect visitor—likely** *Andrena carlini*—**at Red Cedar Recreation Area in Saunders Co., NE. Photos: Kathy Roccaforte.**

My interest in speciation began with a herbarium sheet. In my first semester as a master's student in UNL's School of Biological Sciences, Dr. Robert Kaul, curator of UNL's herbarium, showed me four pressed plant specimens. The plants were hybrids, formed between two species of trout lily that are native to the Midwest, *Erythronium albidum* and *Erythronium mesochoreum* (Figure 1). *E. albidum* is a common woodland wildflower with a broad geographic range that stretches from the Midwest to the East Coast. Its putative sister species, *E. mesochoreum*, is much rarer and is typically restricted to tallgrass prairies.[3] Both of these species are spring ephemerals that flower in April and senesce in late May. Although they tend to inhabit different habitats, populations of the two species can come into close contact with one another where their habitats abut or overlap.

The hybrids on the herbarium sheet raised many questions. If hybridization is possible, how commonly does it occur between these species? How do *E. albidum* and *E. mesochoreum* retain their distinctiveness as separate species in the face of hybridization and possible gene flow?

In addition, I was interested in investigating whether human-induced land use changes that cause woody encroachment into prairie remnants bring *E. albidum* populations into closer contact with remnant *E. mesochoreum* populations, thus increasing the frequency of hybridization. Extensive hybridization and gene flow have the potential to threaten remnant populations of *E. mesochoreum*, an at-risk species in Nebraska.[4] With the help of my advisors, Drs. Sabrina E. Russo and Diana Pilson, I have been addressing these questions for the past three years.

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The Center for Grassland Studies is a unit within the University of Nebraska–Lincoln Institute of Agriculture and Natural Resources. It receives guidance from a Policy Advisory Committee and a Citizens Advisory Council.

Note: Opinions expressed in this newsletter are those of the authors and do not necessarily represent the policy of the Center for Grassland Studies, the Institute of Agriculture and Natural Resources or the University of Nebraska.

Martin A. Massengale .....CGS Director
Pam Murray..... Newsletter Editor
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From the Director

During 2012, the University of Nebraska and other universities will recognize the 150th anniversary of the passage of the Land-Grant College Act of 1862. This legislation was championed by Justin Smith Morrill, a congressman from Vermont. The Morrill Act granted land to each state equal to 30,000 acres for each of its federal representatives and senators to initiate Colleges for the Benefit of Agriculture and the Mechanic Arts (Engineering), but not to the exclusion of other subject matter. Later, other legislation added research and extension duties to the teaching responsibilities.

Prior to the Morrill Act establishing land-grant colleges, which later became universities, higher education in the United States was largely a privilege for the wealthy. Mandates of the original Act were intended to provide access to higher education for U.S. citizens of ordinary means, and to teach subjects that could help people solve real-world problems and advance economically. For many years, these colleges were called "the peoples' colleges" because they were established for the ordinary person.

Frequently, the federal monies associated with the Morrill Act were used for starting a new university or the first university in that state. Michigan State and Pennsylvania State were the first two land-grant universities. Some states formed separate universities for the land-grant and state university functions. The University of Nebraska is an example of one university serving both functions; federal monies associated with the Morrill Act were used to start the University in 1869.

In my opinion, the land-grant universities have elevated the level of education for U.S. citizens because without them there would have been a large number of citizens who would never have attended college. The same could be said about the G.I. Bill of Rights. These were two great pieces of legislation enacted by the U.S. Congress.

After the land-grant colleges were in existence for a number of years, it became apparent that most of the information available at that time had been shared with clientele, and there was a need for more and/or new information. Therefore in 1887, Congressman Hatch from Missouri brought forth new legislation to provide for that research need. This legislation, known today as the Hatch Act, established the agricultural experiment stations to seek, to find, and to discuss new information that could be used to help producers and others.

Again, after several years of classroom teaching and research, it was obvious that there was a great need to disseminate this research-based information to producers and the general public. The Smith-Lever Act of 1914 established today's Cooperative Extension Service. This legislation, which was designed to link land-grant university programs with grassroots needs and national priorities, completed the tripartite mission of the land-grant university and made it a unique concept in higher education. The teaching and dissemination of research information and superior technology developed by scientists at land-grant universities have had a significant part in the fact that Americans have an abundant, affordable and safe food supply while only spending about 10 percent of their income on food. Compared to many countries where their citizens spend half or more of their income on food, we are most fortunate.

The Center for Grassland Studies embodies these research and educational services for all aspects of grasslands and closely related areas. It is, indeed, a prime example of the land-grant university at work for its stakeholders and citizens.

M. A. Massengale

Corn Residue: Nebraska's Great Forage Resource

by Terry Klopfenstein, Aaron Stalker, Adam McGee
and Simon van Donk, Department of Animal Science, UNL

Corn acreage has increased in recent years and grain yields have increased continually for a century. Less pasture is available for cattle in Nebraska due to conversion of acres to corn production. Even alfalfa acres have been converted to corn. This leaves cattle producers with corn residue as an excellent opportunity for minimizing cost of production. We have been conducting research on corn residue since the late 1960s. Considerable research on winter grazing of corn residue was conducted in the 1980s. Because of the increased need to use corn residue as well as changes in corn genetics and production practices, current research has focused on evaluating these changes and also on water use efficiency.

In 2008 research was initiated at a site near Brule, NE. Impacts of corn residue removal are being investigated by applying the following treatments: 1) no residue removal, 2) light grazing (stocking rate of 1 AUM per acre), 3) heavy grazing (stocking rate of 2 AUM per acre), and 4) residue removal by baling. Cattle enter the paddocks about mid-November and exit in January. Grazing treatments are achieved by placing twice as many cattle in the 2 AUM/acre treatment compared to the 1 AUM/acre treatment and holding the number of acres and grazing days constant between the two grazing treatments. Residue cover has been measured several times a year, and soil water content was measured several times a year down to 6 ft. The corn crop is fully irrigated and no-till management is being practiced.

The heavy grazing cattle have lost 0.4 BCS units resulting in a final BCS of 5.5 and 5.1 for the light and heavy grazing treatments, respectively. The results demonstrate the importance of properly managing stocking rate when grazing corn residue. Because there are large differences in the nutrient content of the different parts of a corn plant (husks are better than leaves which are better than cobs and stems), and because cattle preferentially select the more nutrient-dense parts first, stocking rate affects cattle performance. Baling removed approximately 2 tons/acre/yr of corn residue.

Residue cover was lowest on the baled treatment and greatest on the control (no removal) treatment. Residue cover declined between spring and summer because of 1) residue disturbance by the planting operation in May, 2) disturbance by anhydrous application in June, and 3) some residue decomposition due to weather between spring and summer. Not much residue disappeared between November 2010 and April 2011 in the control treatment.

For reducing evaporation of water from the soil, residue cover in a corn field matters most in late spring and early summer when potential evaporation is high (warm, sunny weather) and the crop canopy is not yet closed. The baled treatment (with the least residue cover) lost 4.3 in of water in the top 6 ft of soil between April 5 and August 4, 2010. The heavy grazing, the light grazing, and the no removal treatments lost 2.9, 1.4, and 1.4 in, respectively.

Yield differences were not evident among the four residue removal treatments. When water is limited, economic benefits from water savings due to residue cover can be expected in the form of higher yields. Thus the yield penalty with limited water may be a factor when baling, but would be minimal when grazing.

A second study utilizes a corn field at the ARDC near Mead that has been in a corn/soybean rotation for several years and is irrigated by a linear move irrigation system. The field has three treatments that have been maintained for 14 yrs: a fall-grazed, spring-grazed, and an ungrazed section. On October 2 we collected 10 consecutive complete plants from 24 locations, 8 from each of the 3 treatments. The plants were separated into grain, cobs, shanks, husks, leaf blades, leaf sheaths, and stems. Stems were measured individually and then divided into top 1/3 and bottom 2/3. All of the samples were dried in a 60°C oven, weighed, and analyzed for digestibility. Soybean yields the subsequent growing season and corn yields the next growing season after that were measured with the yield monitor on the combine.

Grazing treatments did not affect digestibility of any plant part, amount of each plant part per unit of total residue, or amount of each plant part per bushel of corn grain yield. Previous studies reported digestibilities for leaf, husk, and cob similar to the current study values, but were higher than our values for stem. The stem was similar in digestibility throughout the plant, with the top only slightly more digestible.

Depending on what particular parts cattle eat, the amount per bushel available to them can range from 8.80 lb to 13.42 lb. Post-grazing observations suggest most or all of the stem is on the ground, but it is very hard to determine if the cattle were eating the upper 1/3 of the stem or not. The leaf sheath remains on the stalk at times and is removed from the stem at other times, suggesting that at least some of the leaf sheath is being consumed; how much probably depends on how tightly the leaf sheath is attached to the stem and if it comes off when the animal is eating the leaf blade.

Past research and current observations show that cattle consume primarily the husk and leaf blade. These parts are the most digestible, apparently most palatable and most readily available for consumption. Of course residual corn is readily consumed, but with hybrids that resist insects and diseases, and with efficient combines, residual grain is less than measured previously.

Because the husk is the most digestible plant part, cattle performance is better when more husk is being consumed than leaf. Further, as grazing continues or stocking rate is increased, more leaf blade is consumed, and eventually some leaf sheath, cob, and upper stem are consumed. This lowers the digestibility of the diet and animal performance declines. Therefore, there is an interaction between quantity and quality. The greater the utilization of corn residue by increasing stocking rate or length of grazing, the lower the quality of the diet and animal performance.

The best indicator of residue (leaf plus husk) available is grain yield because cattlemen know the grain yield before determining stocking rate. Our data suggest the yield of leaf and husk per bu may have declined in the past 15 to 20 years. Samples

(continued on next page)

collected in 2009 showed a range from 13.1 to 19.4 lb/bu of leaf plus husk (average = 15.5) for 12 hybrids grown in western Nebraska. This suggests that hybrid differences and perhaps the amount of leaf and husk per bu are declining slightly with increasing corn yields. Harvest efficiency by cattle may be 50% on average, but may be as high as 70% with heavy stocking. While it is very difficult to estimate, 8 lb/bu of consumable leaf and husk is still a relatively good estimate to use to calculate stocking rate. The interaction of stocking rate and diet quality can be illustrated as follows. If the stocking rate is set so that 6 lb/bu of residue is consumed, and we assume 80% of husk is consumed, then the digestibility of the diet would be about 52%. If stocking rate were higher so that 10 lb/bu were harvested, then digestibility would be 49.4%. Further, if we assume 1.5% of the corn grain is left in the field, then the respective diet digestibility (or TDN) values would be 56 and 52%.

Fall, spring, and ungrazed corn residue treatments have been maintained for 13 years in this corn/soybean rotation. The soybean yields were actually numerically greater from the plots grazed the year before. Spring grazing had no negative effect on the subsequent soybean yield even though spring grazing increases the amount of mud and potential compaction compared to the fall grazing. Corn yields the second year after grazing showed similar results. This suggests that cattle grazing corn residue has no effect on the subsequent yields in irrigated fields.

Editor's Note: McGee is a graduate student. Other authors are UNL faculty members; Klopfenstein is located in Lincoln, and Stalker and van Donk are at the West Central Research and Extension Center in North Platte.

Tracking Trout Lilies: Hybridization, Species Boundaries, and Conservation in the Genus *Erythronium* *(continued from page 1)*

Methods

Our first goal was to assess how frequently hybrids occur in nature. To do this, we located sites in Nebraska, Kansas, and Iowa where populations of the two species come into contact with one another. Because *E. albidum* and *E. mesochoreum* are similar in appearance, hybrids can be difficult to detect based on morphology. To circumvent this problem, we identified hybrids based on genome size. *E. albidum* and *E. mesochoreum* differ in their ploidy level—*E. mesochoreum* is diploid (2n = 2x = 22), whereas *E. albidum* is tetraploid (2n = 4x = 44). Because of this discrepancy in genome size, hybrids have a total DNA content intermediate to both parental species.

We used flow cytometry, a technique that allows one to quantify nuclear DNA content, to distinguish among *E. albidum*, *E. mesochoreum*, and hybrids. We adopted a two-pronged collection method at each contact zone. First, we collected leaf tissue from plants that had physical traits intermediate to the parental species. The purpose of this collection method was to discern whether hybrids occurred at each site. Next, we established several parallel transects at each site, and we systematically collected *Erythronium* leaves along these transects. This systematic sampling was done to estimate the frequency of hybrid and parental species occurrence at each site. Nuclei were isolated from the leaves and were scored as *E. albidum*, *E. mesochoreum*, or hybrid using flow cytometry.

The frequency of hybrid occurrence sheds valuable insight into the strength of species boundaries between closely related taxa. Species are groups of organisms that are reproductively isolated from other such groups by various traits, termed "reproductive barriers."[5,6] These barriers limit or prevent hybridization, thus maintaining genetic distinctiveness among species. Taxa for which reproductive isolation is strong generally hybridize infrequently, and hybrids are often inviable or sterile. In contrast, taxa that are weakly reproductively isolated from one another can exhibit frequent hybridization and gene flow. Closely related plants can be reproductively isolated from one another via multiple reproductive barriers, including flowering asynchrony, pollinator-based forms of isolation that limit interspecific pollen transfer, and physiological barriers that prevent or limit hybrid seed formation.[7] Our study's second goal was to determine the contributions that multiple reproductive barriers play in the maintenance of species boundaries between *E. albidum* and *E. mesochoreum*.

To examine the extent of interspecific flowering asynchrony, we established study plots in multiple eastern Nebraska populations and tracked patterns of flowering for both species. We also captured insects as they were visiting *E. albidum* and *E. mesochoreum* flowers, to evaluate whether the pollinator communities for these plants overlap. In addition, we carried out a hand-pollination experiment in which we performed both hybrid and conspecific crosses, to examine the extent to which physiological barriers limit hybrid seed production. Because *E. albidum* and *E. mesochoreum* are only aboveground approximately 10 weeks per year, we enlisted a small army of "Trout Lily Trackers"—various undergraduates, friends, and family members who wanted to experience field biology research—to help us complete the projects.

Results and Discussion

Our sampling of contact zones yielded few hybrid plants. In fact, of the 352 leaves we assayed using flow cytometry, only 8 plants were of hybrid origin. This indicates that species barriers between *E. albidum* and *E. mesochoreum* are strong.

Overall, we found that the individual reproductive barriers we assessed were not uniformly strong. Flowering asynchrony does not appear to play a consistently strong role in maintaining reproductive isolation between these trout lilies, as *E. mesochoreum's* and *E. albidum*'s flowering phenologies overlapped substantially in our plots. However, pollinator-based isolation likely poses a strong barrier to hybridization between these species. We found that *E. albidum* and *E. mesochoreum* are primarily pollinated by two different solitary bee species—*Andrena carlini* and *Andrena erythronii* (Andrenidae). Though we identified three insect species that visited both *E. albidum* and *E. mesochoreum* flowers, only one of these species (*A. carlini*) was abundant. The majority of insects

we captured belonged to species found only on *E. albidum* or *E. mesochoreum*. Finally, our hand-pollination study indicated that hybrid seed production is possible when *E. albidum* and *E. mesochoreum* are pollinated with heterospecific pollen, but that seed set is significantly reduced. Several physiological barriers, including inhibitory pollen-pistil interactions and hybrid embryo abortion, may be responsible for this reduction in seed set. Overall, our study indicates that species boundaries between these trout lilies are strong. However, individual barriers differed in strength, which emphasizes the importance of considering multiple reproductive barriers in studies of speciation.

Management Implications

Crucially, we also found that woody encroachment into prairie remnants, and concomitant hybridization between *E. albidum* and *E. mesochoreum*, likely do not pose a strong conservation threat to remnant populations of *E. mesochoreum*. Many of our remnant prairie study sites are facing the encroachment of woody plants and non-native grasses, but hybrids were rare or absent at all of our study sites. In fact, it was difficult to locate sites that contained both study species, likely because extensive habitat loss has severely restricted trout lily populations in the Midwest. As an at-risk species, *E. mesochoreum* faces potential decline and extirpation in Nebraska. Because it completes the aboveground portion of its lifecycle in early spring, April prairie burns can threaten populations of this rare plant. Land managers interested in maintaining *E. mesochoreum* populations may consider scheduling spring burns so as not to coincide with *E. mesochoreum* flowering. Late summer haying appears to be very beneficial for *E. mesochoreum* populations, as it reduces early spring leaf litter, allowing plants more light access. Though it has faced severe pressure due to extensive habitat loss, *E. mesochoreum* can be locally abundant and can thrive under these management regimes.

Editor's Note: Kathy Roccaforte is a graduate student who was the 2010-2011 recipient of the Arthur William Sampson Fellowship, which is administered by the Center for Grassland Studies.

References

1. Widmer, A., Lexer, C., & Cozzolino, S. 2009. Evolution of reproductive isolation in plants. Heredity 102: 31-38.
2. Levin, D.A., Francisco-Ortega, J., & Jansen, R.K. 1996. Hybridization and the extinction of rare plant species. Conservation Biology 10(1): 10-16.
3. Kaul, R.B. 1989. The Status of *Erythronium albidum* and *E. mesochoreum* (Liliaceae) in Nebraska. Transactions of the Nebraska Academy of Sciences 17: 71-79.
4. Schneider, R., Humpert, M., Stoner, K. & Steinauer, G. 2005. The Nebraska Natural Legacy Project: a comprehensive wildlife conservation strategy. Nebraska Game and Parks Commission. Online: www.ngpc.state.ne.us/wildlife/programs/legacy/review.asp.
5. Dobzhansky, T. 1935. A critique of the species concept in biology. Philosophy of Science 2: 344-355.
6. Mayr, E. 1942. *Systematics and the Origin of Species.* Columbia University Press, New York.
7. Coyne, J.A. & Orr, H.A. 2004. *Speciation*. Sinauer Associates, Sunderland, MA.

CGS Associates

Charles Francis received the College Distinguished Teaching Award, representing the College of Agricultural Sciences and Natural Resources. The award recognized Francis for his contributions and excellence in teaching, especially in experiential learning.

Walter Schacht was the recipient of the 2011 Lawrence K. Crowe Outstanding Undergraduate Advising Award.

Jerry Volesky was named a 2012 Holling Family Award recipient; he won a Senior Faculty Teaching Excellence Award.

Bob Wright was a member of a group of scientists who received the 2011 Integrated Pest Management Team Award from the Entomological Foundation. The European Corn Borer team documented a 14-year project to suppress the pest. The team conducted a quantitative analysis of population change before and after the introduction of genetically modified Bt corn and found a significant decline in ECB larval and moth populations for five major corn-growing states in the central U.S.

In a February 3, 2012 ceremony, several people were recognized by the University of Nebraska Teaching Council/ Parents Association with the "Certificate of Recognition for Contributions to Students." The Parents Association solicits nominations through an annual mailing, asking parents to nominate a faculty or staff employee who has made a significant difference in their student's life. The 2011-2012 recipients included CGS Associates **Alan Baquet, Chris Calkins, Patricia Freeman, Tiffany Heng-Moss, Bryan Reiling, Steve Rodie**, and **Kim Todd**.

Nebraska Department of Agriculture Director **Greg Ibach** recently received the Government Official of the Year Award at the 55th Agri-Business Exposition of the Nebraska Agri-Business Association in Omaha. Ibach was honored for his work in promoting Nebraska's agricultural products and for working with the agribusiness industry on regulations issues.

CGS Citizens Advisory Council member **Ron Klataske** recently received the Nebraska Wildlife Federation's Conservation Professional award for decades of work protecting the Niobrara, Platte, and other rivers while working for Audubon of Kansas and other organizations.

Baenziger: Ag Challenges to Feed the World Are Unprecedented

P. Stephen Baenziger

Take it from a guy who helps feed the world: There's nothing quite like surveying a field comprising a healthy new variety your research team helped create and recalling, years earlier, "when you held all the seed of it in the palm of your hand."

P. Stephen Baenziger, a University of Nebraska–Lincoln small grains breeder, brought his passion about his work to a Thursday [November 10, 2011] lecture titled "Setting the Stage: Why Agriculture?"

Baenziger was the second speaker in the Institute of Agriculture and Natural Resources' Heuermann Lecture series, which focuses on meeting the world's growing food and renewable energy needs while sustaining natural resources and the rural communities in which food grows.

Baenziger has been on the front lines of that work his entire career, including 25 years at UNL. He inherited and built on a grains-breeding program that has produced wheat varieties now planted on 66 percent of Nebraska wheat acres, as well as in nearby states. He emphasized Thursday, as he has throughout his UNL career, that this work is achieved by a skilled team.

While that success has helped boost income for Nebraska producers — by about $71 million a year, he estimates — Baenziger is even prouder of the fact that UNL's improvements to wheat are responsible for feeding about 2.7 million people a year. That's "why I get up every morning and come to work and why I sleep well at night."

The challenges ahead for agriculture, in Nebraska and around the world, are unprecedented, said Baenziger. He reflected on the last time in human history when the prospect of massive worldwide starvation was staved off by a Green Revolution led by Norman Borlaug and Henry Beachell. Now, 40 years later, with a population expected to reach 9 billion by 2050 — a wealthier population, by the way, that will eat the equivalent of what would feed 12 billion today — agricultural scientists are again racing the clock to help produce enough food.

The Green Revolution's improvements — synthetic fertilizers and a variety of herbicides and pesticides — likely have improved yields all they can, so future progress will depend mostly on genetic improvements by scientists. That will include transgenic changes, resisted by many consumers, and developing new hybrids.

"For the first time, we're beginning to really tease apart our breeding systems so we can be more efficient," Baenziger said.

Baenziger said the world's recognition of the challenge ahead in feeding itself is leading to a new respect for agriculture, which many have been unwilling to see as real science. In fact, Baenziger said, it's humans' "first science," the one that made all future progress possible.

"I think you're going to see some of the very best minds coming to agriculture," he said.

In fact, Baenziger added, Socrates' words from some 2,500 years ago have never been truer: "No one can be a statesman who is entirely ignorant of the problems of wheat."

"We can never be complacent. We always have to be prepared for what the future brings," he said.

Baenziger considers himself an optimist, but even he said he's not certain the challenges ahead can be met. "We're asking agriculture to perform at a level that we've never seen before."

But, he added, "failure cannot be an option, unless you're willing to accept starvation."

Heuermann Lectures are made possible through a gift from B. Keith and Norma Heuermann of Phillips, long-time university supporters with a strong commitment to Nebraska's production agriculture, natural resources, rural areas and people.

Editor's Note: Reprinted with permission from author, Dan Moser, IANR News. Baenziger is a CGS Associate. His talk and others in the Heuermann Lectures series can be viewed at heuermannlectures.unl.edu/.

Program Shaping Up for 2012 Nebraska Grazing Conference

The 12th annual Nebraska Grazing Conference will be held at the Kearney Holiday Inn on August 14-15. As always, there will be a mixture of university and agency speakers as well as those who manage grazing operations. These speakers will be from Nebraska and other states.

While the speaker list and presentation titles were not finalized at press time, we can tell you that this year's topics and speakers include:

Tuesday

- Managing for biodiversity and livestock: western areas, Justin Derner, USDA-ARS High Plains Grasslands Research Station, Cheyenne, WY; eastern areas, Sandy Smart, South Dakota State University, Brookings, SD
- Nebraska recipient of 2011 Leopold Conservation Award, Matthewson Family, Potter, NE
- Federal and state endangered species on ranches – cost-share programs, Mike George, USFWS-Ecological Services, Grand Island, NE
- Concurrent Sessions: A) Winter grazing; B) Decision making using monitoring
- Teaching livestock to eat weeds, Kathy Voth, Livestock for Landscapes, LLC, Loveland, CO

Wednesday

- Planning for drought on the ranch – how and why, what to do before drought, writing a drought management plan, risk management options, multiple speakers
- Evaluating grazing system options, producer panel

The two-day pre-registration fee of $80 (**payable to 2012 Nebraska Grazing Conference**) is due to the Center for Grassland Studies by August 1. The fee covers lunch both days, the evening banquet, break refreshments, and the conference proceedings. One-day registrations are also available. Registration fee will be waived for students who will still be in high school next year and who pre-register by the Aug. 1 deadline, compliments of the UNL College of Agricultural Sciences and Natural Resources. Reduced registration fees apply for other full-time students. Late fees apply to registrations postmarked after August 1 and to walk-ins.

Participants of any of the previous Nebraska Grazing Conferences as well as all Nebraska extension educators will receive a brochure in the mail in June. Others may contact the CGS office to be placed on the mailing list. Information and the registration form will also be on the CGS web site (grassland.unl.edu).

The conference is a collaborative effort with many co-sponsors. Contact the Center for Grassland Studies, one of the underwriting sponsors, with questions.

2012 Nebraska Range Shortcourse

The Nebraska Range Shortcourse is scheduled for June 18 to 22, 2012 on the campus of Chadron State College. The shortcourse is sponsored by UNL, Chadron State College, and the Nebraska Section Society for Range Management. It is designed to provide individuals who have an interest in range management, natural resources or agriculture an opportunity to increase their knowledge in the field of range management.

The week-long course taught through a series of classroom and field sessions focuses on underlying principles of range management for efficient, sustainable use of rangeland for multiple purposes. Course topics include: evolution of vegetation and ranching on the Great Plains; geology and hydrology of the Northern Great Plains; range plant physiology, growth and structure; determining ecological site and condition; habitat management for wildlife; and balancing forage supply and demand

The shortcourse can be taken for credit through UNL or Chadron State College. Sixteen Continuing Education credits are available for the SRM "Certified Professional in Rangeland Management" program.

Applications are due May 18, and enrollment is limited to 50 participants. The registration fee of $225 includes educational materials, transportation associated with field trips during the week, and breaks. Food and lodging can be arranged with Chadron State College.

For more information, see the web site, agronomy.unl.edu/nebraskarangeshortcourse, or contact the coordinator, Walt Schacht, wschacht@unl.edu, 402-472-0205.

Call for Papers: 5th National Conference on Grazing Lands

The Fifth National Conference on Grazing Lands (5NCGL) will be held December 9-12, 2012 in Orlando. The conference is hosted by the Grazing Lands Conservation Initiative (GLCI) and several other sponsoring organizations. The conference objective is "to heighten awareness of the economic and environmental benefits of grazing lands." This year's theme is: "Grazinglands, a Magical Environment," in keeping with Orlando and the Magic Kingdom.

The target audience includes agricultural producers, academicians, consumers, government agency personnel, conservationists, environmentalists, urban-based resource interests, grazing land managers, landowners, and others interested in effective natural resources management.

The conference is designed to provide a forum for discussion and exchange of information, technology transfer, identification of research and program needs, marketing of products, services, and other benefits of grazing. It will generally be organized into four tracks: 1) western grazing lands, 2) central grazing lands, 3) eastern grazing lands, and 4) dairy grazing land management.

Abstracts are being accepted for both oral and poster papers in the following categories within each track:

- Issues concerning the agricultural-urban interface.
- Successful "cutting edge" management technologies for grazing practices.
- Economic/marketing implications of grazing.
- Public policy implications of grazing.
- The optimizing of grazing land health for environmental and social benefits

Farmers and ranchers are particularly encouraged to present. All accepted papers and poster abstracts are eligible for publication in the conference proceedings. Abstract deadline is May 1. Submission details can be found at glci.org under the Grazing Conference tab.

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Resources

What is the Grazing Lands Conservation Initiative (GLCI)? What are the current grazing land resources in the U.S.? What conservation tools have been developed to help better manage grazing lands? There are nearly 600 million acres of non-federal grazing lands. What are the critical issues facing management of these lands, which represent the single largest watershed cover type in the U.S.? Why should you care? The answers to these and much more are in the new GLCI strategic plan for 2010-2015 titled "Sustainable Grazing Lands: Providing a Healthy Environment," now available online at glci.org/assets/GLCIStrategicPlan_Rev_2012_Web_Version.pdf. Hard copies may be obtained by contacting Kim Stine, Kimberli.Stine@ftw.usda.gov, 817-509-3318.

The second edition of *Flora of Nebraska* is for serious botanists. Its nearly 1,000 pages contain information, color photos and line drawings on more than 1,900 species, including keys, detailed descriptions and distribution maps for all native and introduced species that grow outside cultivation in the state. It incorporates thousands of updates to the 2007 first edition based on new plant sightings and on changes in taxonomy. The book's co-authors, Nebraska botanists who have collaborated for decades, span three campuses: Robert Kaul, research professor and curator of botany at the University of Nebraska State Museum, Lincoln; David Sutherland, University of Nebraska at Omaha biology professor emeritus; and Steven Rolfsmeier, herbarium director at Chadron State College. Published by the Conservation and Survey Division, School of Natural Resources, University of Nebraska, the volume is available for $80 at the Nebraska Maps and More Store in Hardin Hall at 33rd and Holdrege streets on UNL East Campus, and can be found online at nebraskamaps.unl.edu/. It is also available on Amazon and at local and regional booksellers.

The relatively new website, Managing Drought Risk on the Ranch, provides information, strategies and resources to help landowners in the Great Plains reduce the threat drought poses to livestock and forage operations. Check it out at drought.unl.edu/ranchplan.